Therapy 7:1-10 (1996); Santodonato, L., *et al.*, *Gene Therapy* 4:1246-1255 (1997)). In another *ex vivo* study, cervical carcinoma and leukemia cells were transfected with a viral vector containing the interferon-consensus gene, and the transfected cells were injected into mice (Zhang, J.-F. *et al.*, *Cancer Gene Therapy* 3: 31-38 (1996)). In all of these *ex vivo* studies, varying levels of anti-tumor efficacy, such as tumor regression and/or prolonged survival, have been observed.

Viral or plasmid vectors containing interferon genes have also been used in *in vivo* therapy for tumor-bearing mice. For example, a viral vector containing the interferon-consensus gene was injected into mice bearing transplanted MDA-MB-435 breast cancer, hamster melanoma, or K562 leukemia, and tumor regression was reported (Zhang, J.-F. *et al.*, *Proc. Natl. Acad. Sci. USA* 93: 4513-4518 (1996)). In a similar study, a plasmid vector containing human IFNβ gene complexed with cationic lipid was injected intracranially into mice bearing a human glioma, and tumor regression was reported (Yagi, K. *et al.*, *Biochemistry and Molecular Biology International* 32: 167-171 (1994)). In a murine model of renal cell carcinoma the direct intratumoral injection of an IL-2 plasmid DNA : lipid complex has been shown to result in complete tumor regression and a significant induction of a tumor specific CTL response increase in survival (Saffran *et al.*, *Cancer Gene Therapy* 5: 321-330 (1998)).

Plasmid vectors containing cytokine genes have also been reported to result in systemic levels of the encoded cytokine and in some cases, biological effects characteristic of each cytokine in mice. For example, the intramuscular injection of plasmid DNA encoding either TGFβ, IL-2, IL-4, IL-5, or IFNα resulted in physiologically significant amounts in the systemic circulation of the corresponding cytokine polypeptide (Raz, E. *et al.*, *Proc. Natl. Acad. Sci. USA* 90: 4523-4527 (1993); Raz, E. *et al.*, *Lupus* 4: 266-292 (1995); Tokui, M. *et al.*, *Biochem. Biophys. Res. Comm.* 233: 527-531 (1997); Lawson, C. *et al.*, *J. Interferon Cytokine Res.* 17: 255-261 (1997); Yeow, W.-S. *et al.*, *J. Immunol.* 160: 2932-2939 (1998)).